

NOTE-BOOK



Review Questions in Applied Entomology, Part 1.
February, 1925.

I. General conception of the insect.

1. What is an insect?
2. General classification of the insects.
3. Mention more important reference works on entomology, pure and applied.

II. Ecological basis of applied entomology.

4. What is a biological complex? An ecological complex?
5. What is meant by "the balance in nature"?
6. Why is nature a system of dynamic equilibrium?
7. In what sense is applied entomology based on ecology?
8. Why is every species of some economic importance?
9. What do the complex charts of Shelford and Davies signify?

III. Losses caused by insects.

10. Discuss the kind, nature, and extent of economic losses caused by insects.
11. What is meant by indirect losses? Health loss?
12. Give a definition of an insect pest.

IV. Food habits of insects.

13. Give a classification of the food habits of insects.
14. What are the apparent and real food stuffs of insects?
15. What salts are essential for the life of an insect?
16. What roll do the microorganisms play in the nutrition of insects?
17. How do the insects obtain their proper food in their various life-history stages? Roll of maternal instinct?
18. Discuss the various types of the mouth-parts of insect.
19. What effects or results does the feeding by the insects produce on their food plants?

20. Are there any cases where the effect is chemical? Examples?
21. Discuss the dissemination of the plant diseases by insects.

V. Injuries to the plants resulting from the insect activities other than feeding.

22. Discuss injuries due to oviposition, pupation, nest-formation.

VI. Superabundance as a cause of the insects becoming pests. (Numerical cause of the pest production.)

23. What are the two series of causes responsible for the superabundance of insects?
24. Discuss the fecundity of insects and its economic significance.
25. Discuss the gregariousness and its economic significance.
26. Discuss the migration of insects and its economic significance.
27. What is the importance of artificial dissemination of insect pests from the economic point of view? In America? In Japan?

VII. Hibernation.

28. What are the three alternatives open to insects in order to survive a protracted period of adversity such as a severe winter?
29. What are the characteristics of a hibernating insect?
30. Discuss the physiology of hibernation.
31. What are the economic significances of hibernation?

VIII. Letisimulation.

32. What is meant by death-feigning?
33. Discuss the physiology of letisimulation.
34. What is the economic significance of death-feigning?

IX. Predatism and predators.

35. Define predatism.
36. Discuss predatism among insects.
37. Discuss the utilization of predators in economic entomology.

X. Parasitism and parasitic insects.

38. Define parasitism.
39. Give a classification of various parasitic relationships, together with a definition of each category.

40. What is a parasitoid? Give some examples.
41. Discuss parasitism among insects.
42. Discuss hypermetamorphosis. Examples?
43. Discuss parthenogenesis. Examples?
44. Discuss hyperparasitism. Examples?
45. Discuss superparasitism. Examples?
46. What is the economic significance of hyperparasitism and superparasitism.

XI. Parasites as a facultative agency of control.

47. What is meant by a facultative agency of control?
48. Why is facultative agencies of control important?
What is meant by the formula in this connection?

49. Discuss the theoretical efficiency of parasites as control agencies. How is their approximate efficiency estimated?
50. Discuss the practical efficiency of parasites as a control factor.
51. Discuss the history of employment of natural insect enemies in control work.
52. Mention the six points necessary to consider before attempting the introduction of parasites against imported pests.
53. What warning did Dr. Howard of U. S. A. give in this connection?
54. Discuss the so-called Fiske's "Sequence theory of parasitic control."
55. Criticise the weakness of the theory.
56. Under what limited conditions does the theory of ~~parasitic control~~ apply.

XII. Insects as beneficial or useful organisms.

57. Mention 11 points of how insects become useful to man.
58. Mention 7 points of how insects become injurious.

Applied Entomology (or Economical Entom.)

angewandte Entomologie

l'entomologie appliquée

Division of applied entomology:

agricultural - Horticultural (H. & G.) - ; Domestic or Household - ;
Forest - ;

commercial - & industrial (Sericulture, apiculture, Dyestuff^{etc.}) ;
Medical - Veterinary (Sanitary) ;

what is an applied Entomology?

- 昆虫学は、その知識を、農業、園芸、林業、家畜、衛生、工業、商業、医学、獣医学、衛生学等に適用する学問である。 applied science + 昆虫学 = 応用昆虫学

Reference to general biology.

- Victor E. Shelford: - Principle of Animal Biology.
Shelford: - Animal Communities in Temperate America.*

Reference to entomology proper.

- Berlese, Antonio: - Gli Insetti
- Lefroy, M: - Manual of Ent.
- Henneguy L. F. - Les Insectes.

Anatomical & others.

- Lang, A: - H. der Morphologie der Wirbellosen Tiere.
- Jordan, H: - Vergleichende Physiologie Wirbellosen Tiere
- Winterstein: - Handbuch der Vergleichenden Physiologie.

Applied Ento. proper.

- Fernald, H. T. - Applied Ent.
- Sanderson and Pearis: - Insect pests of Farm, garden & Orchard.
- Shingorland and Crosby: - Manual of Fruit Insects.
- Crosby and Leon Leonard: - Manual of Vegetable-garden Insects.
- Lochhead: - Claubook of economic Ent.
- * The university of Chicago press Chicago, Illinois.

O' Kane :- Injurious Insects.

Ornament:- Textile of agricultural Ent.

Byrnes:— Insects and Human Welfare. 1920

Hemide:—Insects injurious to the household and annoying to man.

Reh. Soaner: Handbuch der Pflanzenkrankheiten. Bd. N-V.

Forest Ent. proper.

Mississin. Rhumbler: Forstinsektenkunde.

- o Escherich: — Die Foraminiforen Mitteleuropas.

Barbey: — Traité d'Entomologie forestière.

Stealing :- Indian Forest Insects (Coleoptera)

Felt: — Insects affecting Park and Woodland Trees.

Medical history.

Martini: — Lehrbuch der medizinischen Ontologie.

9. Ri leyana Johansen : - Handbook of Medical Ent.

Patton & Cragg: - A Text-book of medical chr.

- o Hervors: — Medical & Veterinary Ent.

Pierce: — Sanitary Env.

Naville & Buckle: — the principles of insect control.

Japanese authors

15 冰炭口部：①木炭口部書編，果15口部書編，龍果口部書編，
②木口部書編。

松林松年：一衣甲是也

喜橋 雙一乳架, 乳架, 果樹, 普通植物, 乳架

明正 34: - 養正 古 4 4

宋本同上一字：一實中實女與原法

譯者 附：一 鄰國在地的哥倫比亞

九毛信勝：一實用昆蟲學要義

Arthropoda: 分類

Summary Note
See list No. 1.

A. ²atracheata

Class 1. Crustacea

繭糸 = 絲 繭糸股・filamentous

B. Tracheata

Class II. Onychophora

1000-212.07 38905. *Vilamorus + 2*

Class III. **Diplopoda**

壳2.5. 壳口 = 10. 1. 4. 7. 1. Periatidae

class N Chilopoda

同治二年十一月 庚子年十月

class V. Hexapoda

Class VI. Arachnida

Cephalothorax

trachea + bookling 呼吸器

8347. abdomen. $\frac{2}{3}$ $\frac{1}{2}$ (10)

O'Keefe: - Injurious Insects.
Ormerod: - Textbook of Agricultural Ent.
Brues: - Insects and Human Welfare. 1920
Hemile: - Insects injurious to the household and annoying to man.
Roh. Sauer: - Handbuch der Pflanzenerkrankheiten. Bd. IV-V.
Forest Ent. proper.

Nüssli u. Rhumbler: - Forstinsektenkunde.
Eschenh.: - Die Forstinsekten Mitteleuropas.
Aarby: - Traits d'Entomologie forestière.
Seethig: - Indian Forest Insects (Coleoptera)
Felt: - Insects affecting Paved and Woodland Trees.
medical proper.

Martini: - Lehrbuch der medizinischen Entomologie.
Riley and Johnson: - Handbook of Medical Ent.
Patton & Craft: - A Textbook of Medical Ent.
Horns: - Medical & Veterinary Ent.
Pierce: - Sanitary Ent.
Naville & Biddle: - The Principles of Insect Control.

Japanese authors

片山忠雄: - 日本森林害虫学. 昭和12年, 昭和13年, 昭和14年.
日本森林害虫学

片山忠雄: - 日本昆虫学.
片山忠雄: - 日本森林害虫学. 昭和12年, 昭和13年, 昭和14年.

片山忠雄: - 日本昆虫学.
片山忠雄: - 日本森林害虫学. 昭和12年, 昭和13年, 昭和14年.
片山忠雄: - 日本昆虫学.
片山忠雄: - 日本森林害虫学.

Characteristics of Arthropoda

1. Bilateral symmetry
2. Heteronomous segmentation
3. Paired, segmented appendages
4. Chitinous exoskeleton
5. Alimentary canal - axial
Heart or blood vessel - dorsal
Nerve (central) - ventral, paired, chain-like
6. Sex - almost invariably separate

Arthropoda 分類

Summary Note
See Part No. 1.

分類: 1. 節足動物門 (Arthropoda)

A. Attracted

Class I. Crustacea

B. Tracheata

Class II. Onychophora

Class III. Diplopoda

Class IV. Chilopoda

Class V. Hexapoda

Class VI. Arachnida

2nd - 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

~~Distinctive characteristics of the class of Arthropoda~~

reference:- O Comstock : 1-24

Packard : 1-25

Fernald : 1-5

Shall : 260-274

Onychophora	Segmentation	Oegs	etc
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~~Arthropoda~~

- | | |
|-------------------------------------------------------|--------------------|
| I. most primitive Arth. | 1. Onychophora |
| II Aquatic series | { 2. Crustacea |
| | { 3. Palaeostracha |
| III Offshoot of its aquatic series secondarily aerial | 4. Arachnida |
| IV Regenerate Arth. of doubtful position | { 5. Pycnogonida |
| | { 6. Tardigrada |
| | { 7. Pentastomida |
| V. Primarily aerial series | Onychophora |
| | 8. Diplopoda |
| | 9. Paurpoda |
| | 10. Chilopoda |
| | 11. Symphyla |
| | 12. Myrientomata |
| | 13. Hexapoda |

distincting character :- Habitat, Body segmentation (division), antennae, Legs, Respiration (呼吸器官, booklung = 2nd pair of trachea), body form, Reproductive orifice (position of)

Hexapoda (hex = six, pous = a foot)

Insecta (insectum = cut into, inseco = cut into)
(昆虫, 2 representation from)

Summary Note

List No. 1.

① 呼吸 = aerial

② 体の明 = 三つの部分 = 頭部 + 胸部 + 腹部

③ 触角 = 一對

④ 複眼 = 一對

⑤ mouth-parts: 1 pair of mandibles, 1 pair of maxillae, 1 labium.

⑥ 足 = 三對, 胸部 = 連結, 腹部 = 八節

⑦ 翅: 四對 = 一對又一對. 中胸 = mesothorax 及 metathorax = 第三對

⑧ position of reproductive orifice = 体内位置 = 生殖孔

⑨ life history (中) metamorphosis = 現存の形

現存の形 = 約 4500 種, 年々 3000-6000, 新種記載 = 多

species, 地球に全動物界, 7割以上, 凡 3/4. 今日, 自然界, 昆虫完全支配する. 現存の形

① Linné / Systema Naturae. 11 edition 1758 (3rd ed.) 6th ed. 生物界, 17世紀, 分類, 基礎を築く.

order, genus, species / 三つ = 分類の単位. 2. genus, 現存の family

species of genus = 当 genus の 種

order on wing, number & nature = 翅の構造, 性質, 数

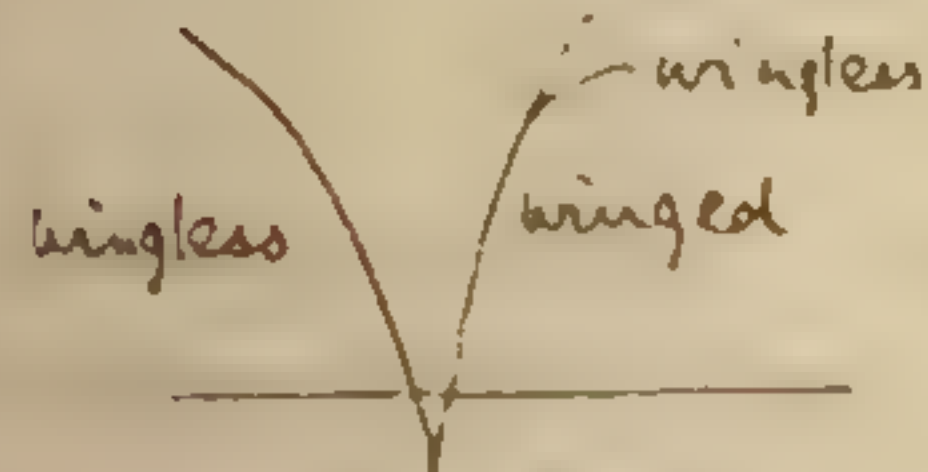
(pteron) = 翅. 2. order, 1. pteron 翅の構造, 性質, 数

order ie. 1. Coleoptera. 2. Hemiptera, 3. Lepidoptera.

4. Neuroptera. 5. Hymenoptera. 6. Diptera. 7. Aptera.

② 211 5, 532:5 5-2 1.0741

F. Brauer	1885	17 orders
A. S. Packard	1886	16
J. H. Comstock	1895	19
D. Sharp	1895	9
A. Handlirsch	1908	35 (163, $\frac{1}{2}$ 24)
Brues & Melander	1915	38 ("
A. & Mac Gillivray	1923	23 (153, $\frac{1}{2}$ 11)
J. H. Comstock	1924	25



Apterygota ^{present}
 Thysanura 1.00 0
 Collembola 1.00 0

Platygaster

Orthoptera -
Zoraptera, Isoptera 7/27 D
Neuroptera Dobson 8/1-11
Ephemera
Odonata
Plecoptera 11/27 D
Corrodentia 11/27 D

Embryoides $\frac{1}{2} \times 0$ $\rightarrow 0.4 \times 10^{-1}$

Thysanoptera 絨絨蟲 (Phytophaga Aeneis)

Anoplura (A) or Scaphunculator

Homoptera Cicada, Aphids. scale-bugs etc.

Hemiptera (Heteroptera)

Dermaptera 15 (10) or Euplexoptera 25 (10)

Coleoptera

Strepsiptera

Meconopsis 罂粟科

Trichoptera in Caddis flies

Lepidoptera

Diptera

Strophomyces 111 210 fleas

Нүүгч мөмөртөгч

reference Committee: 209-219.

Math battle primitive = "Bird-Tunes."

~~Concluded in 1912.~~

Rodgers face sticker

- 2. primary cuticle
- 2. secondary cuticle

x Integument



Epidermis } Cuticle ^{4th}
 (= cuticle) See Forssom p 66 index.
Dermis } hyperdermis hypodermis etc.
 } fascient membrane (^{100% in} { H })

[illegible]

Meliponini 1. Kopyov 1911. Cuticula "colloid" ?
structure "reticular" similar

2. Biedermann 1902 & many others. fibrillae at an angle of 60° to the opening of the collidium trichopore

Critica hypodermis 皮下組織. 1-2層の細胞から成る. 492頁上段
cuticula 表皮. 1層の細胞から成る. 492頁下段
cuticle 表皮. 1層の細胞から成る. 492頁下段

#2. 100% $C_{60}H_{100}N_8O_{38}$ - Sandwich

 $C_{15}H_{26}N_2O_{10}$ - Krukenberg

$C_{18}H_{15}NO_{12}$ - Stead, Lehmann u. Schmidt

 $C_{15}H_{24}N_2O_2$ — *gautier*

14. 7. 09. 28 = 0.1, 1 + 24 + 17h + 1 x cuticula = 1/2 sp 6(7)

~~$$4.2. \text{ 10. } \text{ の } \lambda + \mu + \nu + \gamma \quad \rho / \text{ 4. } \phi - \gamma \gamma \gamma \gamma - \#4 =$$~~

1. ♀ - 31.10.19. Cuticula: $\frac{1}{2} + 2 + 1 + 1 + 1$.^{xx}

Ectodermis / 1st function


1. 体 + 组织 2. 外骨骼 + 肉 + 附着点 + 作用

Ecdysis = molting or Häutung. 127, 28. 29, 30, 31, 32

~~Mr. J. H. Schaefer~~

xxx Sharp. p. 163

9

molting fluid = 1 mm. L. & 2-3 mm.  } cuticle
molting gland (molting fluid = 1 mm.)

68 = dermis + i.e. 1st primary cuticula - it's 1st (from 50% Y
50% D) ARB 17 2nd + 3rd + 4th new cuticula - it's 1st + 2nd + 3rd + 4th (epidermis)

[illegible]

Ecdysis / function (1) growth, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st, 32nd, 33rd, 34th, 35th, 36th, 37th, 38th, 39th, 40th, 41st, 42nd, 43rd, 44th, 45th, 46th, 47th, 48th, 49th, 50th, 51st, 52nd, 53rd, 54th, 55th, 56th, 57th, 58th, 59th, 60th, 61st, 62nd, 63rd, 64th, 65th, 66th, 67th, 68th, 69th, 70th, 71st, 72nd, 73rd, 74th, 75th, 76th, 77th, 78th, 79th, 80th, 81st, 82nd, 83rd, 84th, 85th, 86th, 87th, 88th, 89th, 90th, 91st, 92nd, 93rd, 94th, 95th, 96th, 97th, 98th, 99th, 100th, 101st, 102nd, 103rd, 104th, 105th, 106th, 107th, 108th, 109th, 110th, 111th, 112th, 113th, 114th, 115th, 116th, 117th, 118th, 119th, 120th, 121st, 122nd, 123rd, 124th, 125th, 126th, 127th, 128th, 129th, 130th, 131st, 132nd, 133rd, 134th, 135th, 136th, 137th, 138th, 139th, 140th, 141st, 142nd, 143rd, 144th, 145th, 146th, 147th, 148th, 149th, 150th, 151st, 152nd, 153rd, 154th, 155th, 156th, 157th, 158th, 159th, 160th, 161st, 162nd, 163rd, 164th, 165th, 166th, 167th, 168th, 169th, 170th, 171st, 172nd, 173rd, 174th, 175th, 176th, 177th, 178th, 179th, 180th, 181st, 182nd, 183rd, 184th, 185th, 186th, 187th, 188th, 189th, 190th, 191st, 192nd, 193rd, 194th, 195th, 196th, 197th, 198th, 199th, 200th, 201st, 202nd, 203rd, 204th, 205th, 206th, 207th, 208th, 209th, 210th, 211st, 212nd, 213th, 214th, 215th, 216th, 217th, 218th, 219th, 220th, 221st, 222nd, 223rd, 224th, 225th, 226th, 227th, 228th, 229th, 230th, 231st, 232nd, 233rd, 234th, 235th, 236th, 237th, 238th, 239th, 240th, 241st, 242nd, 243rd, 244th, 245th, 246th, 247th, 248th, 249th, 250th, 251st, 252nd, 253rd, 254th, 255th, 256th, 257th, 258th, 259th, 260th, 261st, 262nd, 263rd, 264th, 265th, 266th, 267th, 268th, 269th, 270th, 271st, 272nd, 273rd, 274th, 275th, 276th, 277th, 278th, 279th, 280th, 281st, 282nd, 283rd, 284th, 285th, 286th, 287th, 288th, 289th, 290th, 291st, 292nd, 293rd, 294th, 295th, 296th, 297th, 298th, 299th, 300th, 301st, 302nd, 303rd, 304th, 305th, 306th, 307th, 308th, 309th, 310th, 311st, 312nd, 313th, 314th, 315th, 316th, 317th, 318th, 319th, 320th, 321st, 322nd, 323rd, 324th, 325th, 326th, 327th, 328th, 329th, 330th, 331st, 332nd, 333rd, 334th, 335th, 336th, 337th, 338th, 339th, 340th, 341st, 342nd, 343rd, 344th, 345th, 346th, 347th, 348th, 349th, 350th, 351st, 352nd, 353rd, 354th, 355th, 356th, 357th, 358th, 359th, 360th, 361st, 362nd, 363rd, 364th, 365th, 366th, 367th, 368th, 369th, 370th, 371st, 372nd, 373rd, 374th, 375th, 376th, 377th, 378th, 379th, 380th, 381st, 382nd, 383rd, 384th, 385th, 386th, 387th, 388th, 389th, 390th, 391st, 392nd, 393rd, 394th, 395th, 396th, 397th, 398th, 399th, 400th, 401st, 402nd, 403rd, 404th, 405th, 406th, 407th, 408th, 409th, 410th, 411st, 412nd, 413th, 414th, 415th, 416th, 417th, 418th, 419th, 420th, 421st, 422nd, 423rd, 424th, 425th, 426th, 427th, 428th, 429th, 430th, 431st, 432nd, 433rd, 434th, 435th, 436th, 437th, 438th, 439th, 440th, 441st, 442nd, 443rd, 444th, 445th, 446th, 447th, 448th, 449th, 450th, 451st, 452nd, 453rd, 454th, 455th, 456th, 457th, 458th, 459th, 460th, 461st, 462nd, 463rd, 464th, 465th, 466th, 467th, 468th, 469th, 470th, 471st, 472nd, 473rd, 474th, 475th, 476th, 477th, 478th, 479th, 480th, 481st, 482nd, 483rd, 484th, 485th, 486th, 487th, 488th, 489th, 490th, 491st, 492nd, 493rd, 494th, 495th, 496th, 497th, 498th, 499th, 500th, 501st, 502nd, 503rd, 504th, 505th, 506th, 507th, 508th, 509th, 510th, 511st, 512nd, 513th, 514th, 515th, 516th, 517th, 518th, 519th, 520th, 521st, 522nd, 523rd, 524th, 525th, 526th, 527th, 528th, 529th, 530th, 531st, 532nd, 533rd, 534th, 535th, 536th, 537th, 538th, 539th, 540th, 541st, 542nd, 543rd, 544th, 545th, 546th, 547th, 548th, 549th, 550th, 551st, 552nd, 553rd, 554th, 555th, 556th, 557th, 558th, 559th, 560th, 561st, 562nd, 563rd, 564th, 565th, 566th, 567th, 568th, 569th, 570th, 571st, 572nd, 573rd, 574th, 575th, 576th, 577th, 578th, 579th, 580th, 581st, 582nd, 583rd, 584th, 585th, 586th, 587th, 588th, 589th, 590th, 591st, 592nd, 593rd, 594th, 595th, 596th, 597th, 598th, 599th, 600th, 601st, 602nd, 603rd, 604th, 605th, 606th, 607th, 608th, 609th, 610th, 611st, 612nd, 613th, 614th, 615th, 616th, 617th, 618th, 619th, 620th, 621st, 622nd, 623rd, 624th, 625th, 626th, 627th, 628th, 629th, 630th, 631st, 632nd, 633rd, 634th, 635th, 636th, 637th, 638th, 639th, 640th, 641st, 642nd, 643rd, 644th, 645th, 646th, 647th, 648th, 649th, 650th, 651st, 652nd, 653rd, 654th, 655th, 656th, 657th, 658th, 659th, 660th, 661st, 662nd, 663rd, 664th, 665th, 666th, 667th, 668th, 669th, 670th, 671st, 672nd, 673rd, 674th, 675th, 676th, 677th, 678th, 679th, 680th, 681st, 682nd, 683rd, 684th, 685th, 686th, 687th, 688th, 689th, 690th, 691st, 692nd, 693rd, 694th, 695th, 696th, 697th, 698th, 699

(2) excretory. D. schoshaip + F. 87 皮膚の中... 排泄管...
排泄管は、排泄物を体外へ出すための管である。sharp は鋭い。

Mouth parts = mundteile

口器 { 1. Mandibulate = masticatory
2. Suctorial

次給的: $\alpha \cdot \beta \cdot \gamma \cdot \delta \cdot \epsilon \cdot \zeta \cdot \eta \cdot \theta \cdot \iota \cdot \kappa \cdot \lambda \cdot \mu \cdot \nu \cdot \xi \cdot \omicron \cdot \pi \cdot \rho \cdot \sigma \cdot \tau \cdot \upsilon \cdot \phi \cdot \chi \cdot \psi \cdot \omega$

for labrum ^{embriological} 2nd & 3rd month part - 1st & 2nd part -

mandible one pair

maxillae one pair

lābiṣu 1.

(Propharynx /
(Hypopharynx)

Moreno

Comstock: 29-93. Berles: 121-159. Lang: 421-443

0.2120 4 = 1000 stage 1 11:21 80 30 10 10 butterfly etc.

xx 11822: tergum, pleura, sternum:

selaritos: torziles, plaurites, sternitos:
suturales

5.9. Hemip. { labrum: much reduced and immovable
labium: elongated to form a jointed sheath, in which the lamellae
mandibles (more or less serrated) and
maxillae are enclosed - Handb. of Med. Ent. p. 28 -

Types of month parts (Hermes p. 24)

- other non-piercing
Subtype 1 6 piercing stylets. loosely associated within the labium
tubular labium \neq endosoma mosquito } one pair, mandible
" " maxillae
propharynx, labrum-
epipharynx

Subtype " = 12/11 3-12, 1 piercing stylets (chitinized)
(labrum, propharynx) enclosed in labium. 217.
cutting labellor - stomoxys calcitrans (stable fly)

latrum-propharynx, propharynx / ʔ + ɫ + ɛ + ɲ + ɲ + ɲ

4 Hymenopteron type. suctorial in function & also lapping.
mandible for portage & fighting (cutting, but not masticating)

type I.
(biting or
chewing)

immature stage

Same

47

1

•

10

"(continued)"

4

1

11

11

22

" (labium
specialized)

" (functional)

Neuroptera

" (Dytiscus larva exception)
mandibles suctional

" (Myrmecoidae } sutorial
Hemerosibiidae }

2

2

Thysanoptera

Same

Stropsiptera (vestigial)

" (functional)

Hemiptera

13

proboscis in form of a greatly elongated ... non-piercing
 suctorial
 © * Alvah Peterson 'The head capsule and mouthparts of Diptera' 1916
Illinois Biological Monographs Vol. III No. 2.

- Homoptera " "
- Anoplura " "
- V. Diptera " (primitive larvae sometimes mandibulate) ^{unsegmented proboscis which may or may not contain piercing parts}
- Siphonoptera mandibulate
- VI Hymenoptera-elitogastra " (specialized suctorial) ^{proboscis which may or may not contain piercing parts}
- VII Lepidoptera mandibulate ^{proboscis which may or may not contain piercing parts}

reference Hermis-Medical and Veterinary Entomology. 1915. 23-32

Fig 25 Diptera, Hym Coleop. Neurop. / family ... figures, description food habit (Imago + Immature stage ...)

wing, Ven ... insect, evolutionary history ...

... (Comstock p. 58 ...)

Coeloproct thorax + abdomen ... homogeneous ... Comstock p. 93

ganglion ... pair ... Comstock p. 131.

... Tenterium ... endoskeleton ... Comstock p. 96

salivary glands ... Comstock Fig 117. p. 101

oil gland ...

salivary gland ... glands ... 109

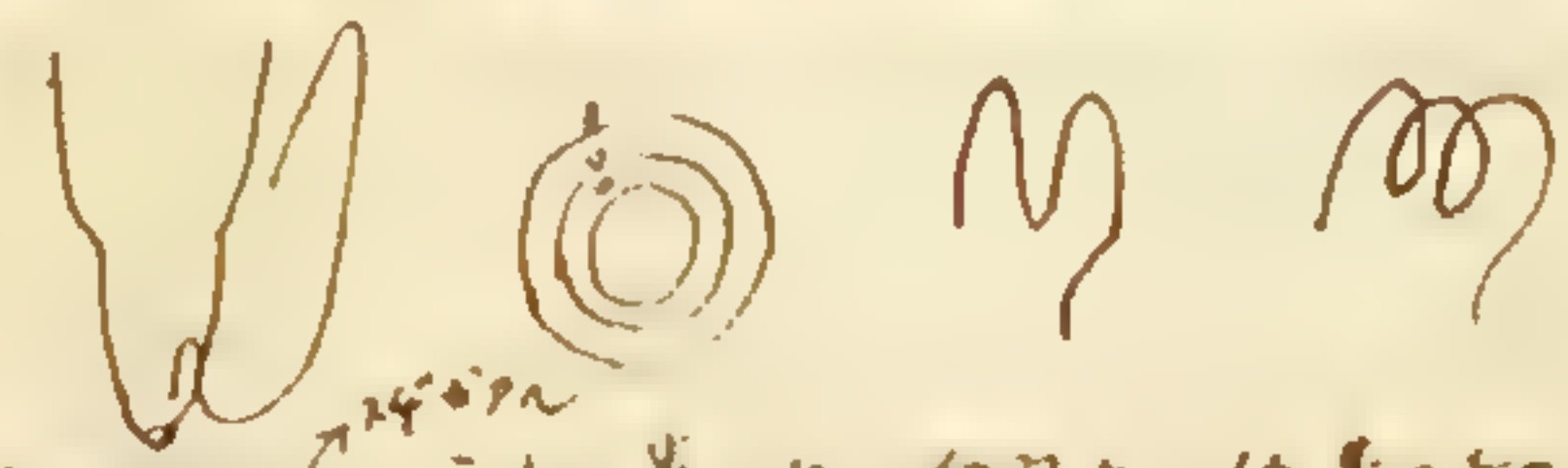
alimentary canal & its appendages Comstock 107-110

function of crop. social life ... Reservoir ...
 honey bee ... = Honig-Kass = Honey stomach. ...
 cockroach ... Fat, digestion, absorption & reservoir ...

proventriculus ^{see Comstock p. 111} ... ^{bitter?} ...

mid intestine (stomach) ... epithelial regeneration ...

... Malpighian vessels ...



rectum. ... family ...

stomach poison.

respiratory organ ^{Comstock} p. p. 113-120

reference. 1. Babak Ed. Die Mechanik u. Innervation der Atmung.
 Winterstein: Handbuch der Vergl. Physiol. Bd. 1. 2 Hälften. p. 361-534
 2. Winterstein, H. 1912 Die Physikalisch-chemischen Ernährungsgänge des

x Schrödter, p. 131 Fig. 224. & p. 163 Fig. 265.

*** Comitate p. 116 Fig 132.

==== Constant p. 117 Fig 135.

Atmung. Winterstein Hdt. I Bd 24. : 22 106-108

03. Reagenor, 1912 Respirationsorgane. Schröders Handbuch der Entomologie. Lief 2-3. 11516-382

4. Loe. M. O. 1915 On the mechanism of respiration in certain
Orthoptera. Jour. Exp. Zoology, 41, pp 125-154.

Calculation of Trachea & Tracheoles 170; left - 1 1/2 + 1/2 = 2.
number of spiracles

数量不明。A24 - 8 封 7612 T, spūvada 24 封。A25 封 10 封 n. maximum.

Terms of spiracle distribution ^{Constock} p. 115. peripneustic; Prop., Metap., Amplip.

Shivade - 1st closing function (irritating substance - 1st. $\therefore R_2 \text{ (2. 1st.)}$
1st 2) under 1st + 1st 2nd & close up. 1st 2nd + 2nd

Trachea, JHE hypodermis - cell (16). $tp = \frac{1}{2}$, $70-80 \mu$, 1μ . ^{intima} ~~Lat. (194)~~
 $tp = 25 \mu$, 1μ , $24-25 \mu$. 2μ 5μ 70μ 21μ 20μ , trachea, 2μ !
 Fig. 135

trachea \rightarrow $\frac{1}{2}$ to $\frac{1}{4}$ absorption \rightarrow $\frac{1}{2}$ to $\frac{1}{4}$ P.V. (canal pore, $\frac{1}{2}$ to $\frac{1}{4}$ permeable \rightarrow)

tracked, +8°C 194m fluid rise over (18)°C at 700 ft - 194m fluid rise ^{+30.6} (at 700 ft.)

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 100. 1. 10

spiracle? $\bar{q} = 1 \frac{1}{2} \pm (95 \text{ } 100 \text{ } 1000)$ Wehrle and Wehrle;
1925, The Occurrence of mites in the tracheal system of

Certain Orthoptera. Ann. of Entom. Soc. Amer. XLIV: 33-44

2) Sale of Weight Disease + honey bees = 2000 1921 = 2000

○ 已知 $\alpha, \beta, \gamma, \delta$ 是 \mathbb{R}^n 中两两正交的向量，且 $\alpha, \beta, \gamma, \delta$ 是 \mathbb{R}^n 的一组基。证明：对任意 $x \in \mathbb{R}^n$ ，有 $x = \alpha \cos \theta_1 + \beta \cos \theta_2 + \gamma \cos \theta_3 + \delta \cos \theta_4$ ，其中 $\theta_1, \theta_2, \theta_3, \theta_4$ 是 x 与 $\alpha, \beta, \gamma, \delta$ 的夹角。

(311) of Murkowski, R.A. 1921, Ann. of Ent. Soc. Amer. 14.

150-156 27 是含1/4的 Нормальная 211 87. 17 17.

Locustacarus trachealis

** Schröder p. 353 Fig 249.

765.115.02421

Haemoglobin is: respiratory protein, iron + 4, haemoglobin, zinc
copper, iron, 18% + 9. **

Lee / 385 inflax + oöplax " 07.02.23 / 10.08.17. u. a. 2 F. spinnende

4) 2 spiracles & 2 cuticular plates

at 1/2 volume inspiration, expiration = 50% = 28% active 18%

Trachea & circulation

32551 spirale de la an. 222 pe set. ~~100~~ influența (100, 100)

835, 836. exclusively: effluvia (835 in 200, 836 in spiracles)

CO₂ 吸入皮膚より、呼吸器を用いて吸入する。 (Inhalation)

expiration " i.e. active movement \rightarrow "a" \rightarrow

3) $\frac{1}{2}$ Lepidoptera, Odonata, Hymenoptera, Arthropoda + trachea +
-ly + 1/2 $\frac{1}{2}$ 1/2

動詞: friction p.119. flight, 飛ぶ: 飛行機が飛ぶ時間: 空の旅: 飛行機, 飛行機

7 入の国62. 希. 10. 1. 正子: 然りて22. 2. 中. 今分/世支子22. 2. 1. 1. 希. 10. 1. 1.

$\frac{1}{n} \rightarrow \frac{1}{m}$, $n \rightarrow m$

parasite : 07.12 | parasite : 6分, spiracle : 2分, 合計 : 8分.

2. parasito 6 10分, 2分, 1分, Trachea → 17~. 3. chemical process

24 物類: 分給の仕度 順序の正否に

2246, 50R1 5111 *homodictyosa* 5-1111 *trachea*

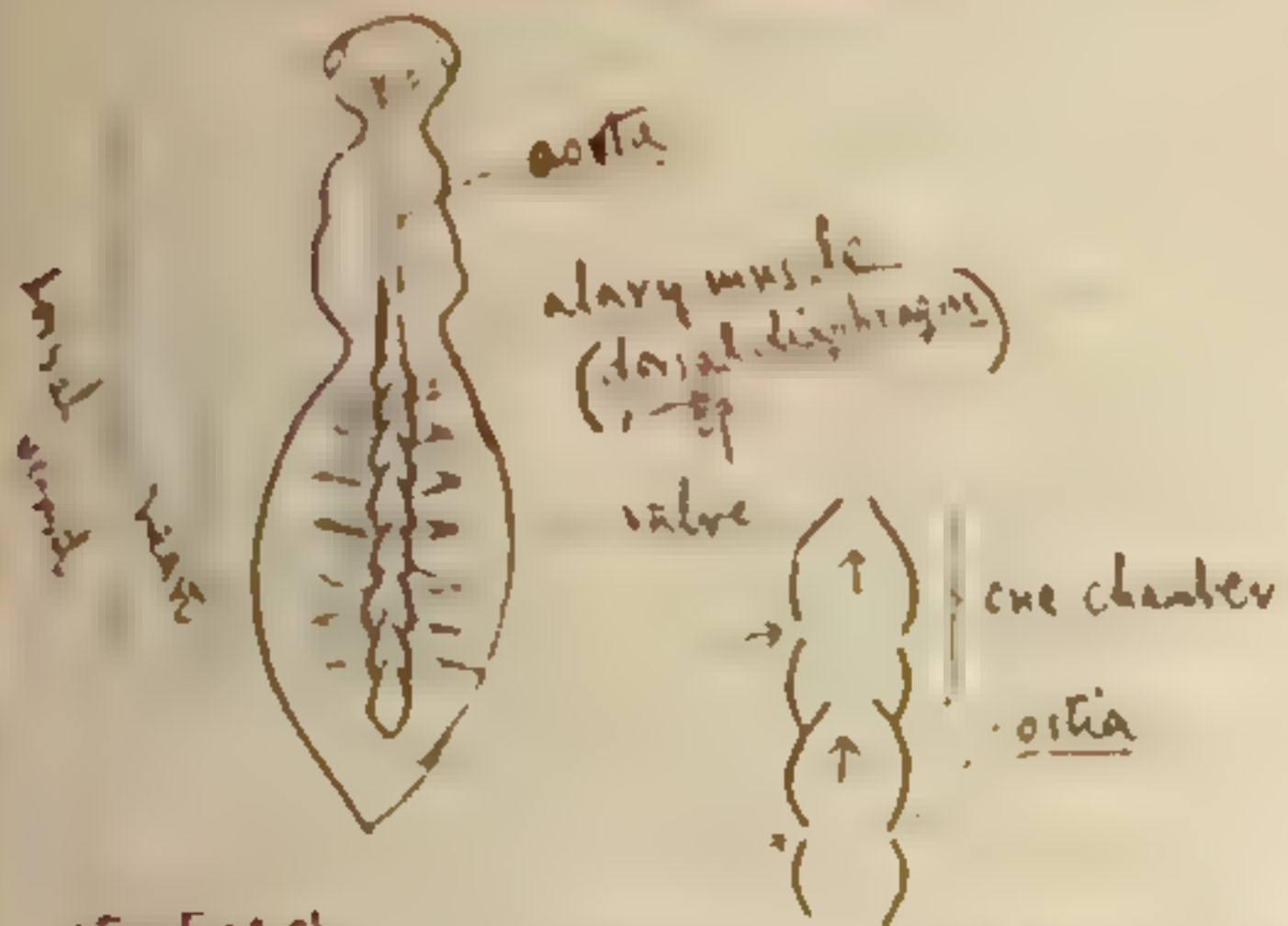
the haemoglobin section is true + g blood gill !!

* See Miyake pp. 217-219 Fig. 142, 143, 144.

5.23. (from Ito's note)

15

circulatory system * open system.
vessel 1 vs. dorsal vessel 1:



structure of

heart posterior end - close to chamber, etc. 8E 11.11.13.152

circulation successive rhythmic contraction 7:2

circulation expansion = Diastole constraction = Systole

rate of publication const. in species var. life history, stage, 1830,

注意: \overline{Ump} 及 O_2, CO_2 / 是等、左右开以

Structure of Blood. plasma (fluid) + leucocytes

color of blood. chlorophyll 2.1.1. 葉緑素, 色が緑. 赤い色はヘム

♂ 雄花: chlorophyll 少, 花冠 + 雄蕊. 2nd arm, cell

12) ... function, ...

function of blood: carry nutrient, to & tissue = (2) 2 tissue

21. "Wade, 11-17, 18-19, 20-21, 22-23, 24-25, 26-27, 28-29, 30-31, 32-33, 34-35, 36-37, 38-39, 40-41, 42-43, 44-45, 46-47, 48-49, 50-51, 52-53, 54-55, 56-57, 58-59, 60-61, 62-63, 64-65, 66-67, 68-69, 70-71, 72-73, 74-75, 76-77, 78-79, 80-81, 82-83, 84-85, 86-87, 88-89, 90-91, 92-93, 94-95, 96-97, 98-99, 100-101, 102-103, 104-105, 106-107, 108-109, 110-111, 112-113, 114-115, 116-117, 118-119, 120-121, 122-123, 124-125, 126-127, 128-129, 130-131, 132-133, 134-135, 136-137, 138-139, 140-141, 142-143, 144-145, 146-147, 148-149, 150-151, 152-153, 154-155, 156-157, 158-159, 160-161, 162-163, 164-165, 166-167, 168-169, 170-171, 172-173, 174-175, 176-177, 178-179, 180-181, 182-183, 184-185, 186-187, 188-189, 190-191, 192-193, 194-195, 196-197, 198-199, 200-201, 202-203, 204-205, 206-207, 208-209, 210-211, 212-213, 214-215, 216-217, 218-219, 220-221, 222-223, 224-225, 226-227, 228-229, 230-231, 232-233, 234-235, 236-237, 238-239, 240-241, 242-243, 244-245, 246-247, 248-249, 250-251, 252-253, 254-255, 256-257, 258-259, 260-261, 262-263, 264-265, 266-267, 268-269, 270-271, 272-273, 274-275, 276-277, 278-279, 280-281, 282-283, 284-285, 286-287, 288-289, 290-291, 292-293, 294-295, 296-297, 298-299, 300-301, 302-303, 304-305, 306-307, 308-309, 310-311, 312-313, 314-315, 316-317, 318-319, 320-321, 322-323, 324-325, 326-327, 328-329, 330-331, 332-333, 334-335, 336-337, 338-339, 340-341, 342-343, 344-345, 346-347, 348-349, 350-351, 352-353, 354-355, 356-357, 358-359, 360-361, 362-363, 364-365, 366-367, 368-369, 370-371, 372-373, 374-375, 376-377, 378-379, 380-381, 382-383, 384-385, 386-387, 388-389, 390-391, 392-393, 394-395, 396-397, 398-399, 400-401, 402-403, 404-405, 406-407, 408-409, 410-411, 412-413, 414-415, 416-417, 418-419, 420-421, 422-423, 424-425, 426-427, 428-429, 430-431, 432-433, 434-435, 436-437, 438-439, 440-441, 442-443, 444-445, 446-447, 448-449, 450-451, 452-453, 454-455, 456-457, 458-459, 460-461, 462-463, 464-465, 466-467, 468-469, 470-471, 472-473, 474-475, 476-477, 478-479, 480-481, 482-483, 484-485, 486-487, 488-489, 490-491, 492-493, 494-495, 496-497, 498-499, 500-501, 502-503, 504-505, 506-507, 508-509, 510-511, 512-513, 514-515, 516-517, 518-519, 520-521, 522-523, 524-525, 526-527, 528-529, 530-531, 532-533, 534-535, 536-537, 538-539, 540-541, 542-543, 544-545, 546-547, 548-549, 550-551, 552-553, 554-555, 556-557, 558-559, 560-561, 562-563, 564-565, 566-567, 568-569, 570-571, 572-573, 574-575, 576-577, 578-579, 580-581, 582-583, 584-585, 586-587, 588-589, 590-591, 592-593, 594-595, 596-597, 598-599, 600-601, 602-603, 604-605, 606-607, 608-609, 610-611, 612-613, 614-615, 616-617, 618-619, 620-621, 622-623, 624-625, 626-627, 628-629, 630-631, 632-633, 634-635, 636-637, 638-639, 640-641, 642-643, 644-645, 646-647, 648-649, 650-651, 652-653, 654-655, 656-657, 658-659, 660-661, 662-663, 664-665, 666-667, 668-669, 670-671, 672-673, 674-675, 676-677, 678-679, 680-681, 682-683, 684-685, 686-687, 688-689, 690-691, 692-693, 694-695, 696-697, 698-699, 700-701, 702-703, 704-705, 706-707, 708-709, 710-711, 712-713, 714-715, 716-717, 718-719, 720-721, 722-723, 724-725, 726-727, 728-729, 730-731, 732-733, 734-735, 736-737, 738-739, 740-741, 742-743, 744-745, 746-747, 748-749, 750-751, 752-753, 754-755, 756-757, 758-759, 760-761, 762-763, 764-765, 766-767, 768-769, 770-771, 772-773, 774-775, 776-777, 778-779, 780-781, 782-783, 784-785, 786-787, 788-789, 790-791, 792-793, 794-795, 796-797, 798-799, 800-801, 802-803, 804-805, 806-807, 808-809, 810-811, 812-813, 814-815, 816-817, 818-819, 820-821, 822-823, 824-825, 826-827, 828-829, 830-831, 832-833, 834-835, 836-837, 838-839, 840-841, 842-843, 844-845, 846-847, 848-849, 850-851, 852-853, 854-855, 856-857, 858-859, 860-861, 862-863, 864-865, 866-867, 868-869, 870-871, 872-873, 874-875, 876-877, 878-879, 880-881, 882-883, 884-885, 886-887, 888-889, 890-891, 892-893, 894-895, 896-897, 898-899, 900-901, 902-903, 904-905, 906-907, 908-909, 910-911, 912-913, 914-915, 916-917, 918-919, 920-921, 922-923, 924-925, 926-927, 928-929, 930-931, 932-933, 934-935, 936-937, 938-939, 940-941, 942

aquatic insect / Hord. O_2 , CO_2 , H_2O (haemocyanin, q_1, q_2, \dots)

Adipose tissue: Sagittary arrangement; its function reserves of nourishment
excretory

Reference Comstock pp 121-123.

Schwider in Wetz. 1b 983 - 411.

Wintersheim Bd I Hf I. 75B-712

Nervous system

nervous system {

1. Central nervous system
2. Oesophageal sympathetic n. s.
3. ventral " n. s.
4. Periphery sensory n. s.

supraoesophageal ganglion (-trunc) . . . 3 ganglia

oesophagus

suboesophageal ganglion . . . 4 ganglia

ganglion .. 3 seg = 1 pair = 1.521 + 2

2017生物... 外... 多... 11月... 10 environment 9.10.2017 2017 11月...

1+2 eig. i.e. hervorsystemgen

structurally, 21 unit $\times 17 \times 9.7$ neurons $\times 7$

Reflex cycle. Neuromuscular mechanism

Diagram illustrating a reflex arc:

- Stimulus** (indicated by a red arrow) acts on the **receptor**.
- The **sensory neurone** carries the signal from the receptor to the **cell body**.
- The **motor neurone** carries the signal from the cell body to the **muscle**.
- The entire pathway is labeled as the **spinal cord = ganglion**.
- The final result is an **action (response)**.

↓ { sense organ - receptor sensory neuron
central nervous organ - adjutor interneuronal neuron
+ central ends of sensory &
motor neurons
effector .. motor neuron

Ex. 7.6.1: Coordination 7天7夜 持续7天7夜

from Parker

System of neuromuscular mechanism

I. independent effector

= a muscle cell

II. Receptor-effector system

But

III. complex receptor & effector system

System

Reference Comstock pp 113-128

Schröder I 119 76-139

Parker, G. H. Elementary nervous system.

Child 1, M. Original development of the nervous system.

Sense organ of 直接 environment

1. 直接环境: 直接环境 (Direct environment)

2. Behavior: 行为 (Behavior)

1. Structural base. 是虫(未发育)的幼虫和2个卵
2. Behavior. 幼虫和卵在巢穴中(卵在巢穴中)

530

Sense Organ cuticular part + int inner + ext outer

Type of sense organ

function, real or apparent

1. Thick walled cucurbit

~~sensit~~
s. sensitum Trichodenum } mechanical
challicum

2. Sense cones (thin walled)

S. *triconicum*
S. *caeloconicum* } chemical
S. *ampullaceum*

3 pore-plata

S. placoderum mech.

4. Olfactory pore (naked nerve)

olfactory

Inc Indian Organ 3927 (Comstock p. 155 & 120)

Position of sense organ antennae, palpi, legs, wings, etc. etc.

Taste (quietately) wasp - 蜂の舌で味をみる 明瞭に味を知る。舌は口の中、舌 = 舌
舌は口の中の一部分である。 : TASTE = mouth part of organ = 舌 Will. hy. neuroptera

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840.

Jawai Olfactory = sense core 712.07 2m → olfactory pore 712.2 2m 1/2 1cm 1/2 1cm

また、*antennae* 1対は2. 4分 = 厚く5分 1本は7分、8分2分 シチムシ、シマバシ etc.

∴ 天竺鼠の2本の antenna → 2 ∴ antenna 7 本の 8 対 25. 天竺鼠の10対の100.

chemotaxo'logy in antennae etc.

27077094-155

| | response |
|---------------|----------|
| Both antennae | 100 % |
| 1 ant. | 49 % |
| 10. ant. | 47 % |

(Minnich)



12) ant. = olfactory organ & 15) int. = 16) ex. organ = 17) int. & 18) ex.

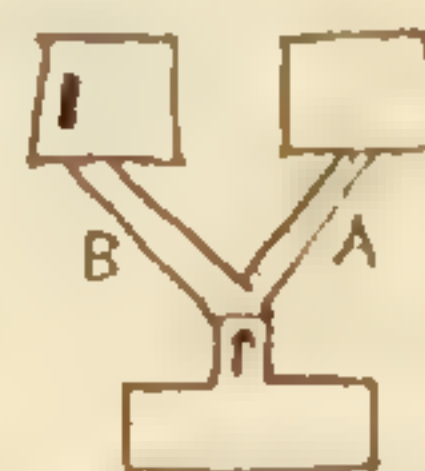
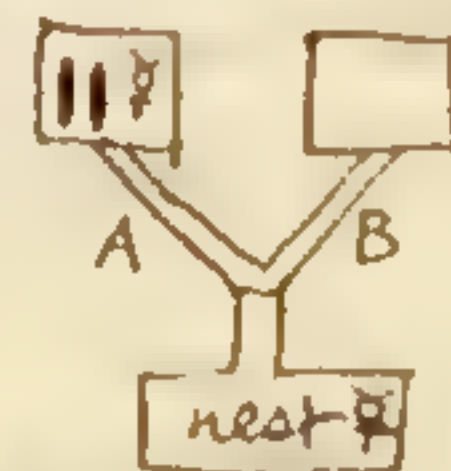
是日分集，於2010年又27日，於27日，於27日，於27日。 False + 111111

[illegible]

$\delta = \frac{1}{2} \pi$ 7 9:00 17x 0, 20 = 小孔 7 穿 17) 又 集 17)

春月滿堂香滿天，不日成去也。又見與子。

Lubbock
余族



识别物又: 道路识别, 又周知物 i.e. Recognition

[illegible]

Woman, 實驗. 26/10/2001 結果 713 100% 政黨 2011 100% 100%

Fielde / 実験 各ノ試験ニ至ルノ度ニ取 1. individual odor 38 x

1954.2.21, 2nd Ant. 10th seg. = Ant. 13th (Ant. 1 seg. 15.84 - 15.86)

2. racial odor. — ant. 11th seg. host odor — ant. 12th seg ... insect odor

مسجد

辨: recognize 辨认, 食物, 动物, 部分, footprint, 街道, 痕迹, 臭, custom (习俗)

(2) 实验 = 王姑 / 结果 明 / 人 / 行 / 为



1915. Von Buttel-Reepen: 24. Nest odor — individual odor, family odor, larval odor, food odor, drone odor, wax odor, honey odor, & recognize.

對於像的在 \mathcal{H} 中全體之非空子集 \mathcal{A} ， \mathcal{A} 之外部集 \mathcal{A}^c 有 $\mathcal{A} \cap \mathcal{A}^c = \emptyset$ 及 $\mathcal{A} \cup \mathcal{A}^c = \mathcal{H}$ 。

Social lip 10/11/09 378 applied ent. 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

Organs of sight 眼の器官は眼と眼の間の空間にあり、光の波長を感知して、色と形を認識する。moving

object を recognize する。眼の構造

mosaic theory

マーズ (Mars)



ommatidium 眼の一部分

inverted image 倒像

day eyes + night eyes. double function 二重機能。眼の一部分は ommatidium である。

夜間の視覚は、眼の一部分の ommatidium によって行われる。

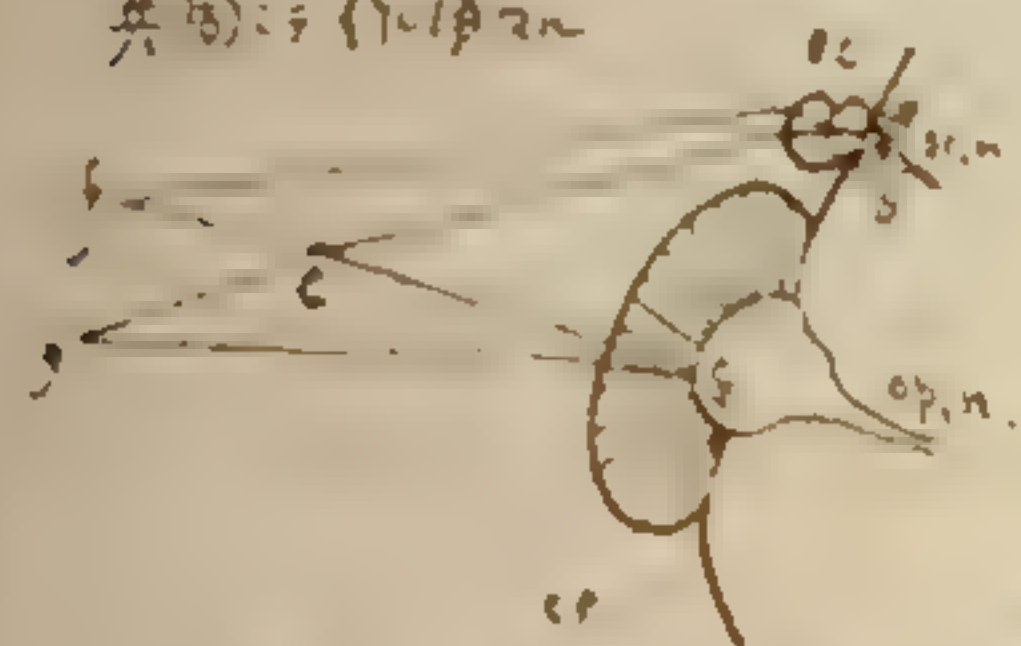
ocelli 小眼。Demoll. 小眼は、眼の一部分であり、光の波長を感知して、色と形を認識する。眼の一部分は ommatidium である。

共同の作用

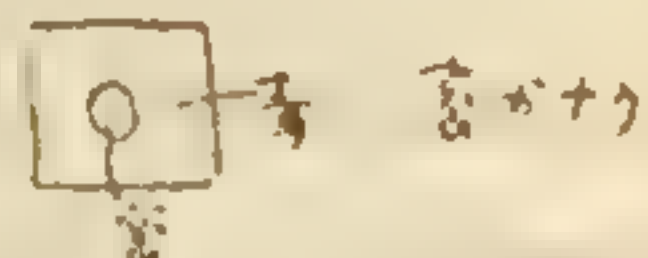
小眼の構造。眼の一部分は ommatidium である。

ocelli 小眼。眼の一部分は ommatidium である。

小眼の作用。眼の一部分は ommatidium である。



Lutrode, 小眼の構造。眼の一部分は ommatidium である。



小眼の作用。眼の一部分は ommatidium である。

Philipp, 小眼の構造。眼の一部分は ommatidium である。

Platou, 小眼の構造。眼の一部分は ommatidium である。

Forel, 小眼の構造。眼の一部分は ommatidium である。

Forel, 小眼の構造。眼の一部分は ommatidium である。

Graber, 小眼の構造。眼の一部分は ommatidium である。

color 色。brightness 明るさ。眼の一部分は ommatidium である。

Plutok, 小眼の構造。眼の一部分は ommatidium である。

Forel, 小眼の構造。眼の一部分は ommatidium である。

小眼の作用。眼の一部分は ommatidium である。

Organ of hearing scolopidium 聴覚の器官。聴覚の器官は、音の波長を感知して、音の強弱を認識する。

聴覚の器官は、音の波長を感知して、音の強弱を認識する。

聴覚の器官は、音の波長を感知して、音の強弱を認識する。

sense organs. reference comstock pp. 29-156

shroder. 1-2 pp. pp 140-233.

Demoll, R - Sinnesorgane der Arthropoden 1917

Winterstein: - Handbuch.

Inactivation of the egg state. Phasmodae $\tau_{in} = \frac{1}{4} \tau_{out}$.

viviparous n. ovo-viparous, 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生.
 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生.
 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生. 胎生 卵胎生.

hatching at 1200. *Opisthonotus* egg-bursters ca. 1300. *Thryothorus*

number of molt. species = 24 $\frac{12}{2}$ 8 1 7 ~~3~~ 8 1 2 1 5 6 + 1. extra

$\text{HCO}_3^- + \text{H}^+ \rightleftharpoons \text{H}_2\text{O} + \text{CO}_2$

[illegible]

adaptation of regeneration, $K_{\text{eff}} = 0.72$ at 20°C , $K_{\text{eff}} = 0.52$ at 10°C , $K_{\text{eff}} = 0.32$ at 5°C .

reproduction of lost limbs. damselfly, caddisfly \rightarrow

是より、 $\frac{1}{2} \times 100 = 50$ 、 $\frac{1}{2} \times 100 = 50$ 、 $\frac{1}{2} \times 100 = 50$ 、reproduction = 繁殖、 $\frac{1}{2} \times 100 = 50$

type of metamorphosis.

| | | | |
|----|------------------------------|------|---------------|
| 1. | egg — larva — imago | | Ametabola |
| 2. | " — nymph — imago | ... | Par ametabola |
| 3. | " — naiad — imago | ... | Hemimetabola |
| 4. | " — naiad — subimago — imago | | |
| 5. | " — larva — pupa — imago | ... | Holometabola |

Summary Note, No. 2,

MOUThPARTS AND FEEDING HABIT
OF
DIPTERA, HYMENOPTERA, COLEOPTERA
AND NEUROPTERA.

Part 2. Hymenoptera.

Month-parts & Feeding habit of Order Hymenoptera

1925-Tune-5 Kingi Imanishi.

For feeding { biting or chewing type ... suborder Chalcidogastera.
 { tapping and sucking type ... " Idogastera.
 { ... " Clitogastera.

I Mouth-parts

i chalcidogastera ordinary orthopterous type.

ii Idogastera { imago? ordinary?
 { larva { labrum, palium & maxilla simple, fleshy.
 { mandible well chitinated.

iii Clitogastera (example: Honey bee).

| labrum | mandible | epipharynx | sucking type
making Proctos | | hypopharynx |
|-------------------------------|-------------------------------------------------------------|------------------------------|-----------------------------------------|---------------------------------------------------------------|-------------|
| | | | maxilla | labrum | |
| narrow
and quite
simple | for passage
& splitting
cutting but
not ractially. | having
a pair of
taste | forming
a sheath
to the
labrum | forming a
tongue (gloma)
which
preparing
channels | absent |

II Feeding-habit

i chalcidogastera : larva) — plant-food. leaves, stems, trunks (living
 and decaying); some making galls.

including many new families — Xylidae, Pamphiliidae, Sireciidae,
 Xiphydriidae, Cephididae, Cimbicidae, Tenthredinidae, Argidae.

ii Idogastera : larva) — animal food. (parasitic)

Family Oxyidae, parasite on larvae of Buprestis & other wood-boring larvae.

iii Clitogastera (mainly larva)

(i) plant food.

superfamily Cynipoidea. family Cynipidae. (including gall wasps)
 superfamily Chalcidoidea. family Chalcididae (a part of)
 superfamily Vespinoidea. family Formicidae (a part of)

(ii) animal food (parasitic)

superfamily Ichneumonoidea. external (some) & internal (most) parasite
 on other insect eggs, larvae, pupae adults)
 including families — Braconidae, Ichneumonidae, Trigonidae, Aulacidae,
 Silephnidae, Gastrancistridae.

superfamily Proctotrupoidea. ^{parasitic on} eggs of ~~on~~ other insects internal parasite
 of other insect larvae. secondary parasites.
 including families — Heloridae, Belytidae, Proctotrupidae, Ceraphronidae,
 Scelionidae, Platygasteridae, Palaeocinidae.

superfamily Cynipoidea. parasite on dipterous larvae & aphids.
 including families — Cynipidae (a part of)

superfamily Chalcidoidea. external and internal parasite of other insects.
 including families — Chalcididae

superfamily Evaniidae. parasite on eggs of cecidomyiids.
 including family — Evaniidae.

superfamily Vespinoidea. parasite on other insects
 including families — Cleptidae, Tiphidae, Mutillidae, Scolidae, Bethyidae.

Phobosomidae. Phobosomidae

nest parasite of other insects

superfamily Sphecoidae

including families — ~~Amphicidae (cockroach)~~ Dryinidae (hemipterous insect)
 nest parasite of other insects.

superfamily Vespinoidea.

including families — Pompilidae (a part of), Chrysididae, Sapygidae.

(iii) animal food (not parasitic)

superfamily Vespinoidea

families — Pompilidae, Tephidae, Formicidae (primitive forms)

superfamily Sphecoidae

family — Sphecidae, Amphicidae (cockroach)

(IV) combined, plant and animal.

family Formicidae, Vespidae (sweet fluid honeydews; other insect larvae)

(V) pollen and nectar only.

superfamily Apoidea. ^{including} (some parasitic)

families — Prosopidae, Andrenidae, Megachilidae, Bombidae, Apidae.

(vi) unknown — Ropronidae, Embolidae, Anthoboidae, Thymidae.

reference — J.H. Comstock. 2nd ed. Introduction to Entomology. pp. 884-920.

R.F. Shodgrass. 1910. The Anatomy of the Honey Bee.

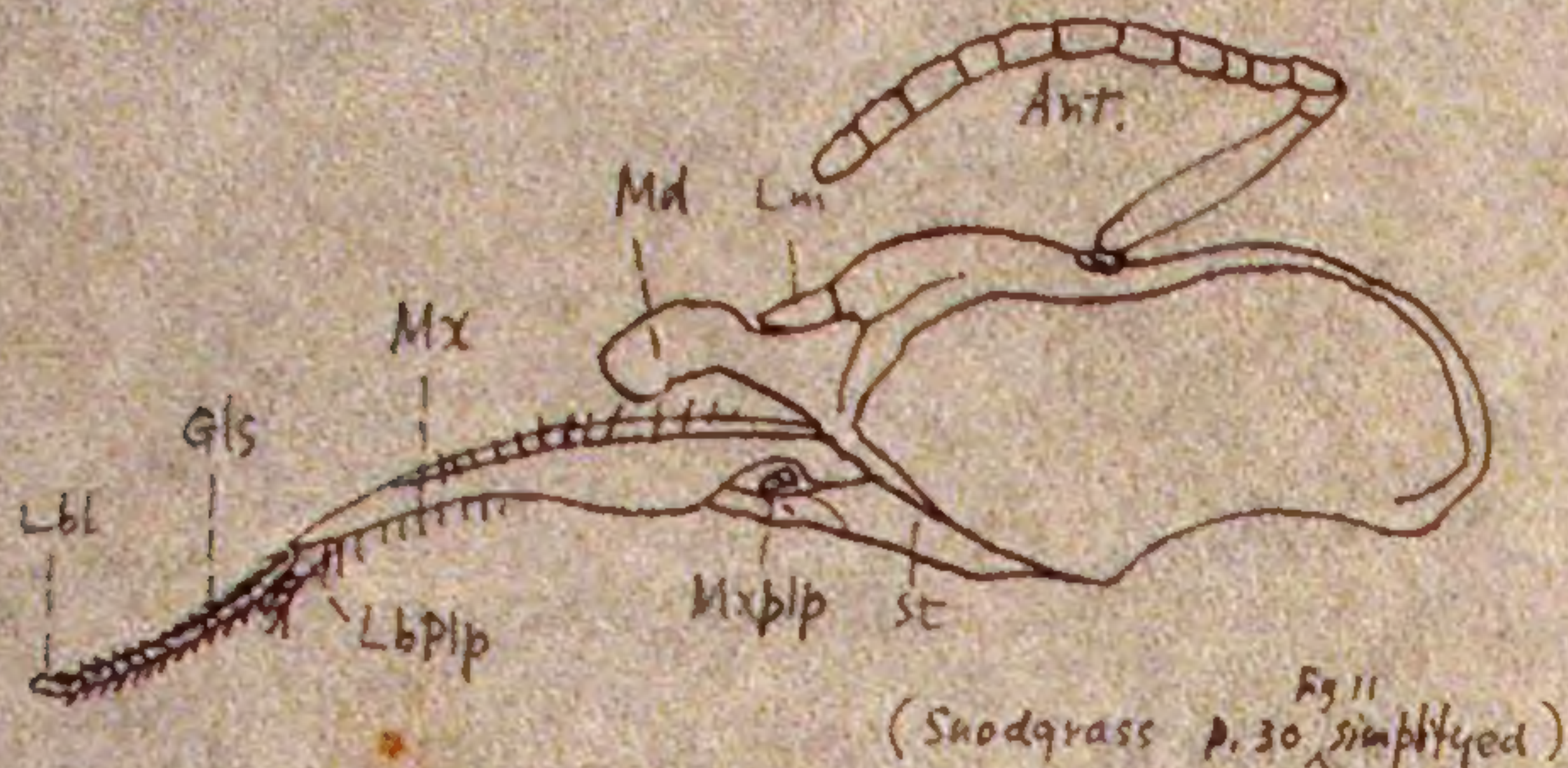


Fig. 1. Longitudinal section through head of worker bet. the median plane and outer edges of mandibles and antennae of left side, all internal soft parts removed.

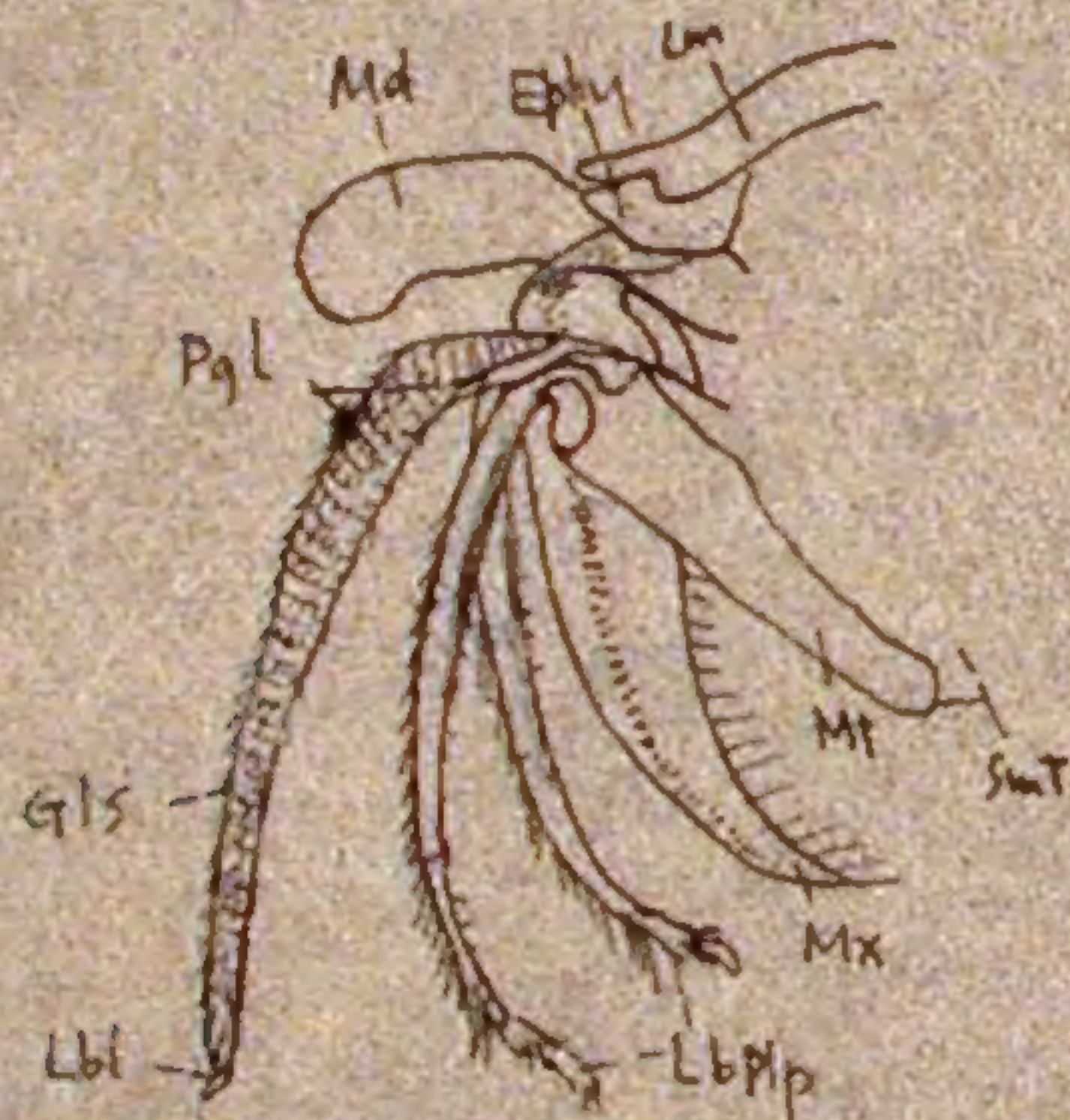


Fig. 2. Median longitudinal section of head of worker, but with entire labium attached, showing internal organs except muscles and tracheae (Snodgrass p. 52 Fig 19 simplified)

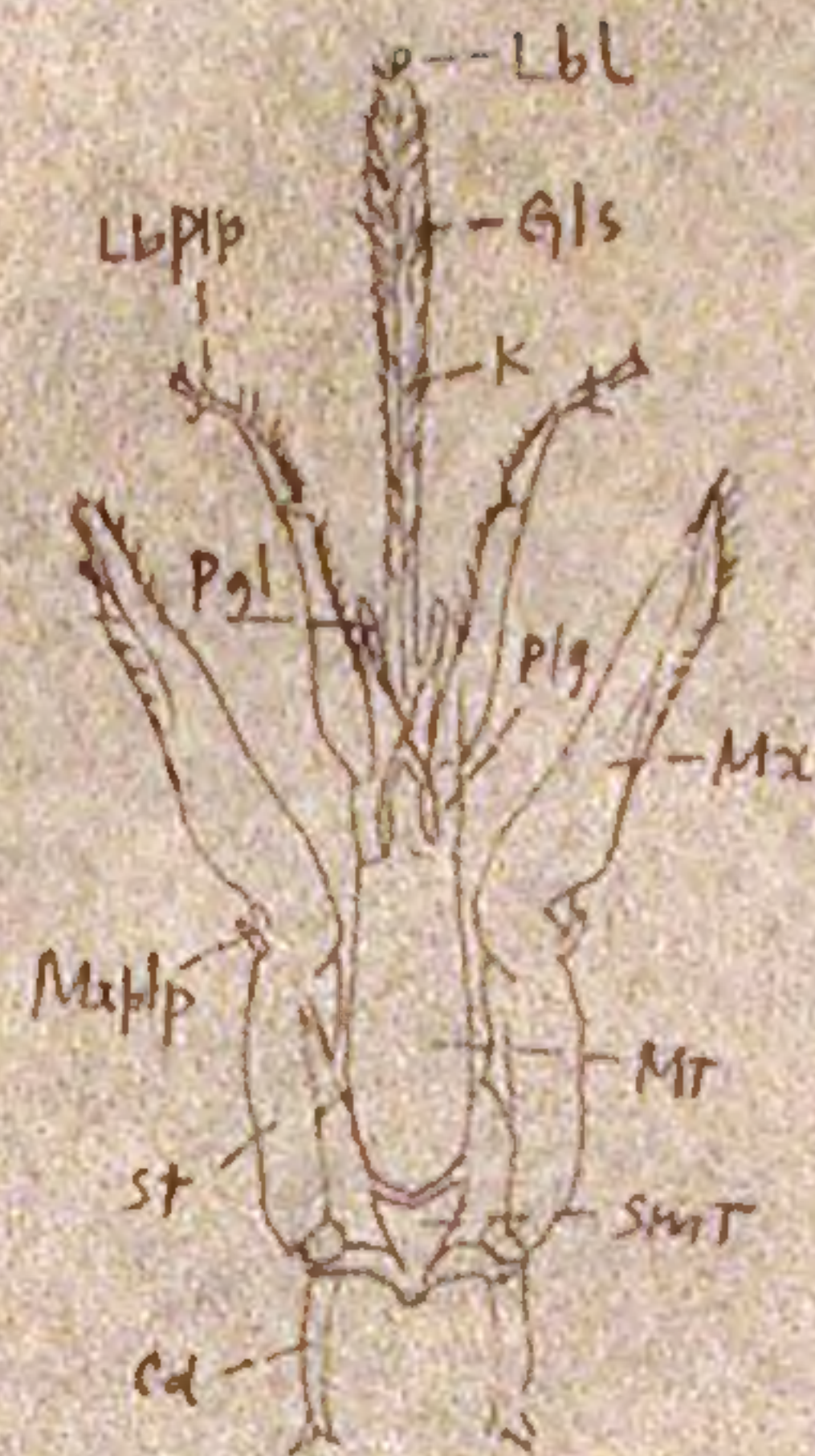


Fig. 3. parts forming proboscis, labium in middle and maxillae at sides flattened out, ventral view, and (Snodgrass p. 53 Fig 15 D & E)



Fig. 4. cross section of glossa showing its invaginated channel and position of rod along its dorsal wall, and likewise position of channel of rod.

Mouth-parts of Honey Bee.

| | | | |
|-------|---------------|-------|-------------------------------|
| Ant | antenna | MxPlp | maxillary palpus |
| Cd | cardo | Pgl | paraglossa |
| Ephy | epipharynx | Plg | palpiger |
| Gls | glossa | Smt | submentum |
| LbL | labellum | St | stipes |
| LbPlp | labial palpus | K | ventral groove of glossa |
| Lm | labrum | L | " of maxillary rod |
| Lum | lumen | Y | inner wall of canal of glossa |
| Md | mandible | r | chitinous rod of glossa |
| Mt | mentum | | |
| Mx | maxilla | | |

I. General consideration of injurious insects.

- 1. Meaning and definition of noxious insects.
- 2. Nature of insect injuries.
- 3. General classification of injurious insects.
- 4. Extent of insect damages and its determination.
- 5. Statistics of insect damages.

II. Ecological point of view.

- 6. What is meant by the ecological point of view?
- 7. Why is it necessary in applied entomology to assume this point of view?
- 8. Discuss organisms as systems of biological complex.
- 9. Discuss environment as a system of dynamic complex.
- 10. What is meant by the ecological complex?
- 11. Discuss the biological cycles using some suitable examples.
- 12. Explain the charts of Shelford, Davis, and Pierce in this connection.
- 13. Discuss the balance in nature.
- 14. What is the origin of an insect outbreak? Give some examples.

III. Ecological considerations of insects.

- 15. Discuss the temperature limits of Davenport, Hunter and Pierce and Bachemjew.

- ✓16. What is meant by optimum Temperature? By developmental zero? By 'kritische Punkt' of Bachmetjew?
- ✓17. Discuss the significance of its 'sprung' in the Bachmetjew's Temperature curve.
- ✓18. To what extent does the Van't Hoff's rule apply to insect metabolism, what is meant by Q_{10} ?
- ✓19. Explain the chemical basis of the Temperature effects.
- ✓20. Discuss the death of insect at low temperatures.
- ✓21. Explain the development curve and its reciprocal. How constructed? What do they signify?
- ✓22. What is meant by the thermal constant of an insect or of its stage?
- ✓23. Mention and discuss the five generalizations of Sanderson and Peairs on the relation of Temperature to insect development.
- ✓24. Discuss the economic use of the Temperature relations in the control of injurious insects.
- ✓25. Discuss the general effects of relative humidity on insect life.
- ✓26. Discuss the significance of water to insect life.
- ✓27. Discuss the four generalizations of Headlee.
- ✓28. Explain the theory of Bachmetjew on the moisture influence on insect metabolism.
- ✓29. Explain that of Headlee.

✓ 30. What is meant by metabolic water? Its sources?

What is the internal water optimum?

✓ 31. Discuss the economic significance of moisture from the control point of view.

✓ 32. Discuss the combined effects of Temperature and Humidity on insect development.

✓ 33. Explain the chart of Pierce showing the relations of Temperature and humidity to cotton boll weevil activity.

✓ 34. State and discuss the modified rule of thermal constant.

✓ 35. Explain the Temperature-humidity scale.

✓ 36. What is meant by Practico-tatum? Hygro-nochelia?
Xeronesthesia? Rhigoplegia? Olethric zone?

✓ 37. Define light physically and ecologically.

✓ 38. Discuss briefly the photochemical reactions and explain why we must refer to them in this course.

✓ 39. What is supposed to happen when light rays strike an insect? The chain of effects or responses?

✓ 40. Discuss the theories of phototropisms.

✓ 41. What do the experiments of Loeb, Holmes, Gnee, and Gross indicate?

✓ 42. Discuss the economic significance of light-rays.

✓ 43. Discuss the effects and uses of X-rays.